Lessons at a Glance

Science Content: Big Ideas

The Energy Unit concentrates on the following Big Ideas. Along with the scientific Habits of Mind discussed on pages 6–7, these concepts are reinforced throughout the unit. The lessons in which each Big Idea is introduced or is a major focus are indicated in parentheses.

Lessons

- Energy takes many forms. (Lessons 1, 2, and 9)
- We can observe energy all around us. (Lessons 1, 2, and 9)
- Energy can move, or transfer, from place to place. Sometimes it changes form as it transfers. (Lessons 3 and 9)
- Machines help us use energy transfers to perform useful tasks. (Lessons 4 and 9)
- Warmer things lose heat, or transfer heat energy, to cooler things until they both become the same temperature. (Lessons 5, 6, and 7)
- Some materials conduct heat energy more easily than others. (Lessons 6 and 7)
- Not all transfers of energy are desirable. Often energy is "wasted" or transferred to non-useful forms. (Lesson 8)

Skill Building Activities

- Paying attention to a book's organization can assist reading comprehension. (Skill Building Activity: Reading Science Books)
- Measurements are not exact, but trying to be accurate is one way scientists can make better comparisons of objects. (Skill Building Activity: Measuring Temperature Accurately)
- Line graphs are charts that can be used to measure how data changes over a period of time. (Skill Building Activity: Making Line Graphs)
- Scientists plan and design fair tests so they can determine how the one variable being changed affects the results of an experiment. (Skill Building Activity: Designing a Fair Test)

Lesson Overviews

The following overviews briefly summarize each lesson in the Energy Unit. Suggestions for scheduling are shown in gray. Asterisks with the lesson title indicate a core lesson.

Lesson 0: Doing Science

Students sharpen their awareness of scientific thinking and become familiar with the "I Wonder" circle as they conduct a self-directed exploration and then reflect on the processes they engaged in. In the context of these experiences, they are introduced to the work of scientists and to the Science Companion "I Wonder" circle, which provides a visual representation of many of the facets of scientific inquiry, exploration, and discovery.

*Lesson 1: Energy Is All Around Us**

The class discusses what they think energy is, where it can be found, things it does, and how it is used. They create "Energy Is All Around Us" collages depicting "energy in action" and stored energy.

This lesson is conducted over two sessions.

*Lesson 2: Energy's Many Forms**

Students participate in a variety of activities to develop their awareness of the various forms of energy, including playing a card game, taking an Energy Walk on the school grounds to search for different energy forms, and creating "Energy Wheels" displaying their "top three" examples of each energy form.

This lesson is conducted over three sessions.

Consider teaching the Skill Building Activity "Reading Science Books" on pages 194–203 after Session 1.

*Lesson 3: Energy Transfers: How Energy Makes Things Happen**

Students operate a variety of toys to figure out the type of energy transfers that occur in each one. They work in small groups, rotating through a series of "energy stations."

This lesson is conducted over three sessions.

Lesson 4: Energy Transfers: Making Boats Go

Students learn how people use machines to harness energy transfers in order to perform useful tasks. They work in small groups to build one of three different boat "machines," each utilizing a different type of energy transfer to propel it. Groups share their boats as they participate in a class boat-launching event.

This lesson is conducted over three sessions.

*Lesson 5: Hot Water, Cold Water: Transferring Heat Energy**

Students begin to understand that heat energy can be transferred from warmer objects to cooler ones. They learn what happens when a container of warm water is placed into a container of cold water by collecting temperature data from each container over time. They graph and analyze the results, inferring that heat energy moves from the warm water to the cold water until the water in each container reaches the same temperature.

This lesson is conducted over two sessions.

Consider teaching the Skill Building Activity "Measuring Temperature Accurately" on pages 204–213 prior to Session 1.

Consider teaching the Skill Building Activity "Making Line Graphs" on pages 214–223 prior to Session 2.

Session 2 is suitable for flexible implementation with mathematics.

*Lesson 6: Conductors: Testing the Transfer of Heat Energy**

Students continue exploring heat energy transfers, focusing on the concept of conduction. They compare how heat energy transfers from a warmer substance—in this case, water—to some cooler objects, and recognize that heat energy is conducted at different rates through different materials.

Consider teaching the Skill Building Activity "Designing a Fair Test" on pages 224–233 prior to this lesson.

*Lesson 7: Building a Better Water Bottle: Slowing the Transfer of Heat Energy**

Students attempt to slow the transfer of heat energy. They test a variety of materials to see which ones act as the best insulator for a water bottle. They design and assemble insulation for their water bottles using materials they think will effectively slow heat energy transfer. Finally, they test their insulated water bottles.

This lesson is conducted over three sessions.

Lesson 8: Getting More for Less: Energy-Efficiency

Students compare three different light bulbs—two incandescent light bulbs and one compact fluorescent light bulb. They learn that light bulbs with the same amount of electrical energy coming into them can produce different amounts of light energy and heat energy. They begin to understand the concept of efficiency and recognize that some things are more energy-efficient than others.

*Lesson 9: Inventions: Getting Energy to Work for Us**

This lesson culminates the Energy Unit. Students weave together what they learned previously about energy transfers and how machines harness energy transfers for useful purposes, and combine it with the spirit of invention. They begin by considering the series of events depicted in a humorous invention sketch and identifying the energy transfers responsible for each event. They design their own invention, showing how a collection of ordinary objects could interact in a chain-like reaction to perform a useful task. After developing their idea, they illustrate how their invention would work. Identifying the energy transfers at each "link in the chain" gives them an opportunity to demonstrate what they have learned.

This lesson is conducted over four sessions. The third session is suitable for flexible implementation with art.

Skill Building Activity: Reading Science Books

Students familiarize themselves with the organization and layout of the *Energy Student Reference Book*. They are encouraged to look through each section before they begin reading so they can use visual and text cues—such as headings, margin notes, and illustrations—to help them understand the material and its relationship to what they already know.

Ongoing reading strategies to help children absorb new information and vocabulary are included at the end of the lesson.

Skill Building Activity: Measuring Temperature Accurately

Students use thermometers to practice taking accurate temperature measurements. They compare their observations with those of others and evaluate the accuracy of their measurements to learn that measurements are not exact.

Skill Building Activity: Making Line Graphs

Scientists often rely on graphs to help them analyze data they collect. A line graph is especially useful to scientists when they need to measure how data changes over a period of time. This activity provides a basic introduction on how to organize data on a line graph and how to use it as a tool to understand the data displayed. By looking for trends on a line graph, the students learn how to make educated predictions, a skill needed for many science activities.

This lesson is suitable for flexible implementation with mathematics.

Skill Building Activity: Designing a Fair Test

An important aspect of any scientific experiment is designing a fair test. In this lesson, students analyze elements of an unfair test and discuss ways to make the test fair. They identify variables that could affect how high a ball bounces and strategize about how to change only one variable while keeping all other parts of the experiment the same.